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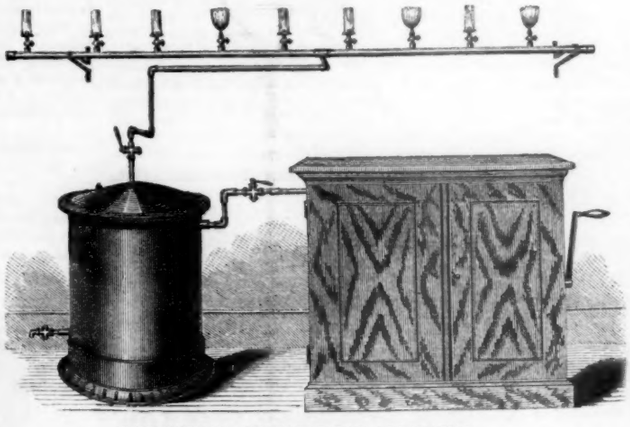
$3 PER ANNUM
IN ADVANCE.

Continental Portable Gas Apparatus.

The public is ever expectant and looking to the inventor to supply its needs. If one, or ten, or a hundred inventions in any particular thing does not fully meet their wants, they will demand better improvements until they are satisfied; and the lucky inventor who finally successfully supplies the want is entitled to, all praise for the courage and persistency which succeeded after so many failures in others.

No class of inventions, perhaps, exemplify so forcibly the above ideas as the portable gas light, hundreds of inventors have tried to supply an apparatus to give satisfaction to the public, and failed in some essential particular.

The portable gas apparatus illustrated herewith, it is believed, fully meets the requirements of the public. It is simple, durable, safe and cheap. One prominent advantage, as will be seen by reference to the cut, is in having the automatic air pump and apparatus enclosed in a small and handsome cabinet, which, with the carbonizer at the left, can be easily transported and quickly put in operation, in any room or house.



CONTINENTAL PORTABLE GAS APPARATUS.

The merits of the machine are best expressed in the report of Prof. Doremus which follows:

"The dark room in which the experiments were performed was in the basement of the New York City College, and unprovided with any means for heating it; and as the tests were chiefly made during the winter months, they were therefore the least favorable for the gasoline light; for, like all liquids, the gasoline yields less vapor when cold than at a more elevated temperature, and as the illuminating power depends on the quantity impregnating the air driven through it. The apparatus employed for these investigations was "Bunsen's Photometric," provided with the standard candle (burning 120 grains per hour) and also arranged for the direct comparison of one gas with another. The candle power of the street or coal gas was when five cubic feet an hour were consumed averaged thirteen candles. The gases were burned under varying pressures, but the results herein reported were made at the pressure of nine-tenths of an inch of water, being about the average under ordinary circumstances. The specific gravity of the gasoline used in the generator through which the air was forced was 85 gravity, at the temperature of 60 deg. F. Five gallons of gasoline were put into the iron receptacle or generator filled with pumice stone; air was driven through, and the absorbed hydro-carbons burnt and their illuminating powers repeatedly tested with that of the street or coal gas of a 13 candle power.

"The illuminating quality of the gas made was averaging 428 *cubic feet of gas made with your generator equalled* 500 *feet of coal gas.* The five gallons of gasoline with air impelled through it yielded 1209 cubic feet of gas, having the illuminating power of 13 candles.

"The safety of your apparatus for burning gasoline is a most essential point for its adoption. I have uniformly refused to give favorable testimony in behalf of the multifarious appliances for burning gasoline, etc., being convinced of their danger, but I have no hesitancy, however, in expressing my belief in the safety of your *substantial and simple contrivance;* for it consists of a strong cast-iron cylinder filled with fragments of pumice stone, in the pores of which the gasoline is held by capillary attraction, and through which the air is forced by the air feeder, which is driven with a spring with means for regulating the pressure, which is wound up by simply turning a crank a few times. All the openiegs of the generator holding the gasoline are protected by wire gauze, for extra precaution, so that although a flame might be applied to any of these openings, it would be impossible to ignite the combustible material within.

"In my opinion, there is neither danger from explosion nor from ignition of the gasoline thus secured. Insurance Companies have no cause to deem it more hazardous than ordinary illuminating gas.

"The results you accomplish may be thus summed up: You utilize an almost waste product—gasoline—by simple means; you convert it into a cheap and most brilliant light, excelling that of coal gas, unaccompanied with unwholesome odors, and *free from all danger.*

"I congratulate you, gentlemen, on being able to offer to the public a *cheap and safe light,* suited for private residences as well as for large establishments, such as hotels, factories, churches, theaters, etc., and which is equally well adapted for steamers, ferry-boats, and sailing vessels."

Further information can be had on application to A. Draper & Co., sole agents for the United States, 40 Courtlandt street, N. Y.

Non-Corroding Water and Gas Pipe.

We notice in the *Scientific American* that Mr. Henry M. Stow of New York, has patented a new water and gas pipe, in which the materials are coiled strips of sheet metal or wire, paper, and pitch, or coal-tar varnish. The pipes thus made, specimens of which have been submitted to us, seem strong, and they are not only much lighter than metal pipes designed to sustain the same pressure, but are totally free from objection in a sanitary point of view.

The pipes are made by coiling around a mandrel, a strip of pitched paper. Outside of the paper coil is then wound a sheet metal or wire coil, which is cemented to pitched-paper coil. If wire is used pitched paper is interposed between the layers.

The partially formed pipe is then covered with single or double roofing pitched paper, and the inside thoroughly coated with hot pitch or coal-tar varnish, which fills all the interstices and gives a smooth interior surface, preventing any contact of water with the metal, and consequent oxidation.

It is claimed that the compound material of which the pipe is mainly composed, being a very slow conductor, the water in the pipe is protected from the effects of frost. For very cold climates or exposed situations the thickness of the outer coating and pitch may be increased to any desired degree, to render the protection from frost perfect: or a coating of pitch and sawdust may be added to increase the thickness. We are informed that it has been proved by experiment, that a pipe of this kind, of ¾-inch calibre, and five sixteenths of an inch thick, will withstand a pressure of five hundred pounds to the square inch. The strength of the pipe may be increased indefinitely by applying more spiral strips of metal interposing pitched paper between them.

It is further claimed that these pipes are cheaper, stronger, and more durable, than metal pipes, and that they are not affected by the acids generally found in water.

For gas mains the pipes are coated on the inside with an acid proof composition. The pipes can be made of any required size, for gas or water mains,

Chemical Repertory,

No. 47.—February 16, 1871.

EDITOR—HENRY WURTZ.

AMERICAN CHEMICAL NEWS.

[ORIGINAL COMMUNICATION.]

LECTURES

AT THE PEABODY INSTITUTE.

By Prof. Henry Morton.

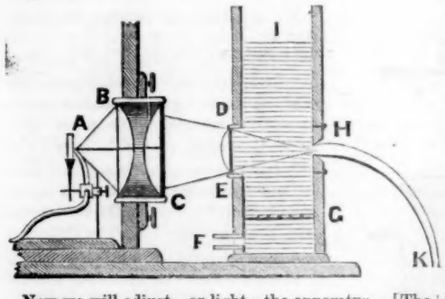
On "LIGHT," with Experiments.

[Revised and Communicated to this Journal by Prof. Morton.]

[Continued from page 35.]

FOURTH DAY—TUESDAY, NOV. 23.

"I propose this evening to take up the subject of reflection, and in order to avoid the delay of bringing to the front and arranging an apparatus, which needs a very nice adjustment in order that its operation may be successful, I will first show you a curious experiment illustrating total reflection. I will afterwards explain the method in which this reflection takes place. Here is an hydraulic arrangement constructed in this way: We have a tank containing water, I, with an aperture at this cork, H, through which the water comes out more like a rod of glass than a stream of water; it will have a perfectly smooth surface; the whole success of the experiment depends upon this. In this box I have a lime light, A, the rays of which are concentrated by powerful lenses, BC, upon the water in the tank at a point directly opposite the aperture. When the stream flows, the rays pass through the tank at a point directly opposite to the aperture. They then pass out into the stream of water, and instead of passing *through* it, they strike upon its surface at such angles that they are entirely reflected and thrown back upon another surface of the stream. So they follow it down. At the bottom where the stream breaks, and its smooth surface is destroyed, they of course break out.



Now we will adjust—or light—the apparatus. [The Professor mounts a chair; a low hum of pleasure rises throughout the hall as

A STREAM OF MOLTEN GOLD,

gleaming with a greenish metallic sheen, leaps from the tank and is received in a goblet on the floor. Here the glowing liquid dances and glances, boiling round a central fire point, and realizing the goblets of *liqueurs diaboliques* told of in the *Comptes Infernales* as regularly offered to visitors at the Courts of his Satanic Majesty. The audience is quite unable to confine its delight to a murmur and breaks out in general applause.] Any ruffling or disturbance of the jet, even by so slight a thing as a step upon the stage, is sufficient to interfere in a marked manner with the effect. [The Professor makes cuts across the jet with his finger, and at each cut a globe of the living light drops down the parabola into the goblet; their flashes quite light up the immense hall.] If I touch the stream with my finger, it breaks the line making a surface from which the light is thrown out—like a falling star. [More cuts and applause.] Now, if we interpose a colored medium between the light and and the tank, we shall color the light, and by consequence, seem to color the stream.

THE GNOMES' CASCADE.

[Ah-h! A stream of pale melted emerald—or is it transparent bronze?—plays into the goblet, and dances and gleams. Oo-oo! Rose-ruby—all aflame; it leaps and boils as it does in the gnomes' crucibles when they make the rubies. Sapphire—pale, living, quivering. Blood! (Applause) Carbuncle and garnet flashing red rays and lighting the whole hall with a rosy glow. Sapphire again—deeply, darkly, beautifully blue—a cobalt blue. (Applause) Orange—a stream of flowing topazes, but deeper and richer than any topaz—as a topaz might be, melted and hot. Still the goblet beneath gleaming and overflowing with the jeweled liquor poured into it—its rays all centering in a fire point, and flaming as these gems were fabled to do in the dark.] And now by

EXTINGUISHING THE LIGHT

in the lantern I shall be able to show you the kind of stream of water [a dull, lustreless stream appears—murmur] we have been using. You see it is more like a rod of glass than a stream of water; if there is any ripple, as there generally is unless special provision be made to prevent it, then the effect fails entirely.

At the conclusion of my lecture I will exhibit another form of illuminated fountain, in which the stream will be vertical, which will be a very pretty illustration of this subject; in this even nicer adjustment is required. The difficulty there is one of hydraulics: we cannot easily get a smooth stream. The water collects in a bunch at the top of the column, and this weighing upon the stream is apt to produce waves—or a wavy appearance in it. By

REFLECTION,

we mean that throwing back of the rays of light from a surface—like the throwing back of waves of sounds; or, a more familiar illustration, the throwing back of an elastic ball, of which the best example is in the case of the billiard ball; in this instance it is known that the angles of incidence and reflection are equal. The angle made as the ray or body approaches the surface, is the angle of incidence; that made as it leaves the surface again is the angle of reflection. For convenience these angles are measured from a line perpendicular to the surface at the point of contact. As I have said, the fundamental law of reflection is, that these two are equal. This is easily notable where the surface is polished. If the surface is rough the rays will come down upon it, and be scattered in every direction. Take a sheet of white paper for instance. The surface of this is rough. Under the microscope it looks like the floor of a hay loft with the hay scattered about. A ray of light comes down on this, is reflected from one straw one way, and from another another way, until it is scattered in every possible direction. While the law holds true we cannot in the case of a rough body like this perceive it to be true. Now I have upon the screen [the light turned down]

A SERIES OF DIAGRAMS,

which illustrate what I have said and what I have to say. [The diagrams illustrate the cases of parallel and again of diverging rays falling upon a mirror; the second showing why it is that an object appears to be as far behind a mirror as it actually is in front of it. All of which is made "clear to our dull comprehension" by the Professor, who in the course of his brief lucid demonstration says]—I am using a mixed rough sort of geometry, which, however, will best serve the purpose, as making the matter plain to every one without an effort.

[A second diagram, in further illustration of the same propositions. We are all made to see and understand why and how our image appears to approach us as we approach a mirror.] And thus it is that people very often make the mistake of stepping aside to avoid their own image, which may appear to be coming toward them through a doorway. [Not half so bad as kicking a mirror to pieces, thinking it a burglar—a feat which flitted across the remembrance of the reporter. The second image on the screen explained in the neatest way the jeweled fountain which had been previously represented, and which we are convinced the audience thought it understood and now perceived that it didn't.

Next was thrown upon the screen a series of exquisite photographs, commencing with a drawing—showing reflection from the surface of still water.] If the surface of the water is ruffled the rays of light are scattered in every possible direction. This is an instantaneous photograph, and

THE SCHOONER

is just 'going about'; you see the shadows on her sails; they look very unnatural; you never saw any like them; they ought to look so, for the sails were in the act of flapping, and when you see that, the motion is so rapid that you do not see the shadow; but the photograph has caught it. [Photograph of statuette reflected from little mirror; explained why knobs on mirror frame reflect light from only single points.] We have also multiple reflections. [Illustration of a candle held in the angle of two reflecting planes set at a right angle, and reflected in four separate ways; puzzling but made clear.] It is on this principle that

THE KALEIDOSCOPE

is constructed, and by it that we obtain the combination of *regular* figures.

These principles have been applied in many useful and some amusing ways. You know the illusion called

THE SPHINX.

[Diagram appears upon the board, to which the Professor's language refers. Although we cannot present the diagram we think that the reference will be quite comprehensible.] In producing this illusion a three-legged table is used, set with one of the legs toward the spectator. From this leg to each of the others a mirror extends, making an angle with the apex toward the spectator—and hiding, of course, whatever is behind them and in their angle.

On either side of the stage, toward the front, are set two candelabra—the stems of which are exactly like the legs of the table. Now suppose a spectator sitting in front here on the right. He looks to the table and he does see the two legs, A and B; he looks between them and he thinks he sees the third leg—but he does not; he sees the reflection of the candelabrum on his own side of the stage. Now he looks at another point between the legs and thinks he sees the drapery at the rear; for the drapery is hung around the stage in a semi-circle; but he does not—for what he does see, is the reflection in the mirror of the drapery on his own side of the stage.

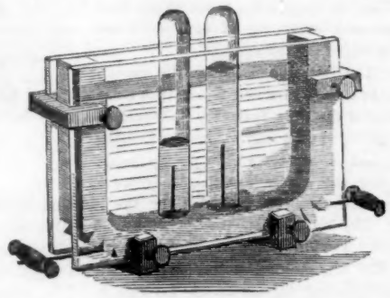
Thus you see the illusion is complete; the spectator looks at the table and is sure that he sees under it, clear quite to the back of the stage. Underneath the table, between the two mirrors, and hidden behind them, is the trap door, through which the man gets up, puts his head through the table and does anything else that may be thought remarkable. [Applause.] There is another of these things which was also first brought out by Prof. Pepper, of London, in his lectures, called the

FLOATING HEAD.

The only reason that I do not show these illusions is because it is essential to have the audience within a comparatively small space. As you are in this hall, a few only would see the illusion, and to the rest there would be no deception at all. [The Professor then simply and lucidly explained the illusion of the Floating Head—the same in principle as the Sphinx, but not quite so easy to make clear without the diagram. After producing the diagram with sines "as a reminder" that refraction might become reflection, a diagram was thrown representing rays entering a square prism, and instead of going through it, going out again in a direction at right angles to that in which they entered.]

THE SQUARE PRISM.

The rays of light enter it and though this is a perfectly clear transparent surface it allows no ray of light to go through it. The Prof. brings forward a block of glass in his fingers.] I have here a square prism of perfectly transparent glass; if we place this in the rays as they come from the lantern, it has the property of reflecting them away. There is no silvering on it, nor anything to prevent the rays going through.] Photograph of a statue of woman and lion thrown on the screen.] I will put in the prism [picture gone] you see the picture on the ceiling. [Applause.] If I rotate the prism, I rotate the image—and as it falls upon different colors, you perceive it produces different tints on the picture. [Woman and lion rotated over the ceiling, the walls, etc.; then suddenly reappears on screen. (Applause.) After explaining the prism which should invert the image, and then make it appear in its true position on the screen.] I have here what will be in a few minutes a tank of water, to show you the



VOLTAIC DECOMPOSITION

of water. [Tank of water upside down on screen, with two spindles sticking up in it.] There you see the fine platinum wires which convey the currents. Now I place one of these prisms in the way of the ray [tank turns right side up] now we will complete the voltaic current—and you will see the decomposition going on. on a rather large scale apparently. [The needles break out in bubbles, which rise in continuous lines: some little bell glasses put on the wires, and the space taken up by the transparent colorless gas turns black—explained to be due to refraction—different density.]

Without delaying longer. I will empty the little tank of water and place in it a solution—chloride of tin—in which the voltaic current will produce a very singular effect. It is the same liquid we used the other day to illustrate refraction.

[Gas down, and the tank and its two black wires appear. There rises from one a thin column of smoke.] You will see presently a metallic growth: the metallic tin depositing upon one of these poles in delicate fern-

like prisms or crystals [a fungous growth begins. [Smoke continuing to rise from the other pole.] We have here the acid liberated at one pole, and the metallic tin at the other. You see it is shooting out somewhat like a cedar tree in its growth [murmur of admiration as one long bough after another grows out and bends down.]

And now while we are using the lantern in this way, I will show you the difference between a body that transmits light and one that reflects it in a great many different ways; I will use a plate of glass covered with a solution capable of crystallizing. It will crystallize in spears cutting off the light and forming a series of figures. [Upon the screen appeared the phenomenon of

A SCUM OF ICE FORMING;

the fantastic tracery of frost goes on before our eyes, gradually extending over the face of the screen. Applause.] I will prepare one more of these, as the effect is often very pretty and different at different times. [A second smeared plate appears.] You there see the solution running down across the face of the plate, You must give it a little time to drain before the crystalizing action—[sensation—a field of bulrushes shoots up, growing luxuriantly, putting out spears like tangled net work—an exceedingly beautiful effect.] There are never two alike; and if we try two or three times, we are sure to get one resembling true vegetation. You see that this looks like a meadow with its full growth of grass.

A very striking and interesting illustration of reflection is furnished by the views we get of the moon through a telescope. You know that it resembles a peeled orange [full moon—very like a peeled orange]. Here you see these radiating bright rays, but when the moon is not full, they disappear entirely. [Quarter moon.] There you see some of the rays proceeding from the crater of Tycho. [More moon.] There is a view showing you the surface of the old moon. Here you see those brilliant markings are utterly absent except on the edge. [More.] Here is another of the same part of the surface when it is much more than half full.

But the most striking contrast is when you have two pictures on a large scale seen together, one of the new moon and the other of the full—when the sun's rays fall upon it vertically or at the moon's noon.

[Two moons or two pieces of the same, taken at different times, and on a very large scale, wonderfully disclosing the details of the surface; a remarkable annular elevation standing out in startling relief.] Different parts of the surface develop effects which are remarkable.

I will show you, in conclusion,

THE VERTICAL JET.

It will require a few minutes for adjustment [during which gas turned up.] While the Professor is adjusting his apparatus, an occasional blinding gleam of the lime light flashes out.] We have now a beam of light reflected from a mirror through a tank arranged to give as smooth a column as possible. Now we will

TURN THE WATER ON.

[A rod of yellow luminous glass—we must call it molten and hot topaz; that gives the idea—rises from the apparatus and bends and breaks in a graceful cascade.] There is a little air yet in the apparatus which will need to go out before the jet will become steady. [The Professor turns it down a little—up a little—ah! there it is perfect; applause.] You see how the light pursues the column and illuminates it throughout.

I now conclude. My next lecture, to-morrow evening, will be upon the subject of "Vision."

[We may remark that this following or fifth of Prof. Morton's Peabody Series, which we are allowed to present our readers next, was comprised in substance in the late splendid lecture delivered by this gentleman before the AMERICAN INSTITUTE, and will serve therefore as a Report of the latter, according to promise.

H. W.]

[ORIGINAL COMMUNICATION.]

PRELIMINARY ACCOUNT OF THE AMERICAN ECLIPSE EXPEDITION.

[The following is the full text of a letter from Prof. YOUNG of Dartmouth, to Prof. HENRY MORTON of Hoboken, upon the Eclipse Expedition to Spain; now for the first time given to the public, in full, through the kindness of Prof. MORTON. An abstract, communicated by the latter gentleman, was by some mistake published in the *Daily Tribune* as a communication thereto direct from Prof. YOUNG. It was unfortunately copied as such into the February issue of the *American Journal of Science;* and our motive in here putting on record the whole document, is in part the rectification of this error.—H. W.]

JEREZ, December 23d, 1870.

PROFESSOR MORTON.

Dear Sir: By the courtesy of Prof. Winlock I am permitted to communicate the general results of our observations of the eclipse. I think I may say that on the whole our expedition has been highly successful, and has fully attained the objects for which it was sent: although perhaps more might have been accomplished had the weather been better. We seem, however, to have been more favored, even in this respect, than any of the English parties which observed in Spain. I have not yet heard anything from the parties in Algeria and Sicily.

Our party of twelve concentrated at Jerez, some 30 miles (by rail) north of Cadiz, about ten days before the eclipse, and although much interrupted by unfavorable weather, our instruments were in position and adjustment in good season. Mr. Dean, assisted by Capt. Ernst and Mr. Gannett, had in charge the determination of our geographical position, using a 46-inch transit, chronometers fitted with galvanic break circuit apparatus, a chronograph, sextant, etc. The photographic apparatus comprised two telescopes equatorially mounted with clock-work, one of eight inches aperture and the other of six inches, besides a horizontal telescope of five inches aperture and about 30 feet focus, with a plain unsilvered mirror of glass to reflect the sun's rays into the tube. Messrs. Willard, Mahoney and Gannett attended to this department.

Prof. Pickering observed for the polarization of the corona with apparatus which I presume he has described in his letter to you. He was assisted by Mr. Ross. Prof. Langley also observed for the same, and for the general features and structure of the corona.

We had four spectroscopes in the field. Professor Winlock used an instrument with two prisms. This was attached to an equatorial of $5\frac{1}{2}$ inches aperture, which formed a distinct image of the object observed on the slit of the collimator. Mr. Clark assisted him at the finder.

My own instrument was the spectroscope figured and described in a late number of your Journal. It was attached to the Dartmouth College Equatorial of $6\frac{1}{2}$ inches aperture, and like Prof. Winlock's, received a distinct image on the slit of the collimator. The observations previous to totality were made with the whole dispersive power, equivalent to 13 prisms. During totality I used seven. As the observations of Prof. Pickering last year, had made it a matter of interest to observe the general spectrum produced by the total light coming from the moon's immediate neighborhood during totality, without any limitations such as are introduced by throwing an image upon the slit, two instruments were mounted for this purpose. The first consisted of the collimator and telescope of my large nine prism instrument, with two of its prisms. The telescopes have an aperture of $2\frac{1}{4}$ inches and a focal length of about 17, and the prisms are of proportionate size, having however an angle of only 45°.

This was mounted upon a board in such a manner that it could have the slit of its collimator readily pointed towards the sun. As its angle of aperture was about 7° it required no great exactness of direction and no movement during the totality. This instrument was put in charge of Mr. Abbay, a member of one of the English parties, who at his own request, was kindly detailed to assist us in the matter, as they had no suitable instrument, and we no spare observer. He brought with him an induction coil and a Geissler tube prepared under Mr. Lockyer's supervision, which gave the combined spectra of hydrogen, mercury, magnesium, and sodium. This spectrum, thrown into the field of view in the ordinary way, formed the scale of reference. Another smaller instrument was fitted up from a star spectroscope of one prism of very dense glass, with collimator of the usual size—about one inch aperture and seven focal length. To increase the light I placed in front of its slit a small telescope magnifying about $2\frac{1}{4}$ times, having a field of $3\frac{1}{2}$°. This was adjusted carefully for distinct vision on a remote object, and its effect was, *not to form an image on the slit*, and thus to limit the locality from which the observed spectrum was derived to some small point, but merely *to increase the virtual angular diameter of the sun and the total amount of light received on the slit.* This instrument was put in charge of Mr. Pye, a young Englishman who was spending the winter at Jerez for the benefit of his health. He had had some experience in spectroscopy, and used his instrument very skilfully and effectively. To all these instruments, excepting Mr. Abbay's, was adapted Professor Winlock's beautiful arrangement for recording the positions of the lines observed. A little chisel is brought down by the simple pressure of the finger upon a silver plate which moves with the telescope, thus a fine line is made which permanently marks the position of any line which may be upon the cross-wires of the instrument. These plates are preserved, and afterwards read off at leisure by a suitable micrometer. Besides those I have named, several English gentlemen joined us in general observations, and in making sketches and drawings of the corona. One of these drawings from the pencil of Mr. Gordon appeared to me in fidelity and beauty to equal anything I have ever witnessed—but I anticipate.

The day and night previous to the eclipse was very fine, but early in the morning it clouded up; when we arose the prospect was very gloomy—it even rained from time to time. We made all our preparations however, and before the first contact (10 25 A. M., local time) there were many patches of partly clear sky, but there was always, even when clearest, enough haze of frost crystals to cause the sun to be surrounded by a conspicuous halo of $22\frac{1}{2}$° radius.

At the time of first contact it was clear enough to allow good observations to be made in the usual method. I attempted to use the spectroscope upon it in the same manner as last year, but failed, on account of the thin cloud which most of the time entirely obliterated the chromosphere lines.

Between the time of first contact and totality, there were several intervals of moderate clearness, in which photographs of the partial phases were taken. Just before totality the clouds became much thicker and we nearly gave up hope; but at the needed time, almost by the direct interposition of Providence as it would seem, a small rift in the now heavy clouds passed over the sun, and permitted us to see and observe the sublime phenomenon, if not in all the beauty and grandeur of last year, yet satisfactorily and most gratefully. Within five minutes after the end of the totality the sky was wholly clouded, and we did not see the sun again till just at evening, after a heavy storm of wind and rain. During the totality one good photograph of the corona was obtained with the six-inch glass, with an exposure of $1\frac{1}{2}$ minute. It is of course by no means so good as it would have been had the sky been truly clear, but it shows a great deal of detail, curved filaments and radial shadings, far better than any ever before obtained.* The picture obtained with the eight-inch glass was injured by not being removed until the sun came out. No attempts were made to photograph the prominences, which can be seen and studied at any time—all efforts were concentrated on the corona.

The details of its structure were not seen this year nearly as well as last by the telescopic observers. The thin cloud shaded out and obliterated definition without however cutting out much light. I think if anything it appeared more extensive than then, but much less definite in its outline; others however thought it less extensive. Its form was as usual roughly quadrangular, nearly square; but it is a curious fact that its longest diagonal was neither equatorial nor polar, but made an angle of almost 45° without the hour circle, lying from the N. W. to the S. E, This was carefully determined by Prof. Langley. There was no prominence on the sun's limb which could compare in magnitude and beauty with the 'anvil' of last year, but there were many small ones which were bright and active.

In respect to the polarization observations I presume Prof. Pickering has fully informed you. It would almost seem that there must have been some peculiar defect in the particular instrument he used last year, as his assistant, Mr. Ross, using the same identical apparatus which Prof. Pickering then did, obtained the same negative result. But apparently similar instruments used this year, conspired with others quite different, in indicating radial polarization of the corona. The appearances in the instruments were much complicated by the cloud and haze, but I believe Prof. Pickering and Prof. Langley both agree that the corona certainly has a considerable proportion of its light radially polarized.

Our spectroscopic results completely confirm those of last year, except that the two faint lines which I saw between D and E last year, and suspected to be corona lines as well as 1474, were not seen at all this time; 1474 was traced by Prof. Winlock to a distance of nearly 20′ from the sun's limb. I traced it 16′ on the west, 12′ on the north, 14′ on the east, and about 10′ on the south. The principal chromosphere lines were also visible in the corona to a distance of 3′ or 4′. But Prof. Winlock and myself both agree in attributing this to the reflection of the haze around the sun. I am the more confident as to this, because last year, in a clear atmosphere the C line was certainly sharply terminated at the upper limit of the chromosphere or prominence under observation. Mr Abbay, in his spectroscope, saw only the 1474 line and the F line—the former considerably the brighter of the two. He saw no continuous spectrum. Mr. Pye saw C (8.5);

* At the last meeting of our LYCEUM OF NATURAL HISTORY, on the evening of February 13, we were gratified with a sight of this picture (a positive on glass) by Prof. MORTON, who had received it but an hour before from Prof. PICKERING, newly arrived from Europe.—H. W.

D3 (5.5); 1474 (10) and F (3). The numbers appended represent the relative brightness of the lines. Still, so far as I am concerned, I should not dare to affirm that there might not have been dark lines without my seeing them, since on account of my using so great dispersive power this spectrum was very faint, except when I widened the slit considerably. With the instruments of Prof. Winlock and Mr. Pye the case is different. I do not think if dark lines existed they could have escaped.

No particular examination was made of the chromosphere spectrum, but I noticed it sufficiently to ascertain that there were probably in it, at least in the particular portion under observation, no lines which I had not already seen under ordinary circumstances. I saw C, D_1, D_2, D_3, 1474, two or three of the iron lines near E, the four lines of b, the two barium lines between b and F, and one of the iron lines often seen there, F, and 2185, which Mr. Lockyer consider a magnesium line. I did not examine the spectrum above this point nor below C. This was on the eastern limb of the sun near the point of last internal contact.

Perhaps I may be allowed to interpolate here that on the previous day I saw, in the spectrum of a very bright but small prominence on the N. W. limb of the sun, the line below C, which I have seen twice before; but have so often looked for in vain, that I had more than half concluded myself to be deceived. It is the reversal of the dark line 656 of Kirchhoff's map. Also in the same prominence, and for the first time I believe, the three *chromium lines just below* b. Of course D and D_2 and all the lines of b were very bright in it, as well as many of the iron lines seldom seen.

But the most interesting spectroscopic observation of the eclipse appears to me to be the ascertaining at the base of the chromosphere, and of course in immediate contact with the photosphere, of a thin layer in whose spectrum *the dark lines of the ordinary solar spectrum are all reversed.*

Just previous to totality I had carefully adjusted the slit tangential to the sun's limb at the point where the second contact would take place, and was watching the gradual brightening of 1474 and the magnesium lines. As the crescent grew narrower I noticed a fading out, so to speak, of all the dark lines in the field of view, but was not at all prepared for the beautiful phenomenon which presented itself, when the moon finally covered the whole photosphere. Then the whole field was at once filled with brilliant lines which suddenly flashed into brightness, and then gradually faded away, until in less than two seconds nothing remained but the lines I had been watching. The slit was very close, and the definition perfect. Of course I cannot positively assert that all the bright lines held exactly the same position that had been occupied by dark ones previously, but I feel very sure of it, as I particularly noticed several groups, and the whole arrangement and relative intensity of the lines struck me as perfectly familiar. Mr. Pye saw the same thing, for an instant only; Prof. Winlock did not, as his telescope at the time in accordance with his directions, was pointed to a spot at some distance from the sun's limb. Mr. Abbay did not see it.

This observation is a confirmation of 'Secchi's continuous spectrum' at the edge of the sun, and I think tends to make tenable the original theory of Kirchhoff as to the constitution of the sun, and the origin of the dark lines in the ordinary solar spectrum.

I must not close this communication without a reference to the courtesy and kindness we received from the inhabitants of Jerez. Everything possible was done to assist us, and to make our stay agreeable.

Very truly yours,

C. A. YOUNG.

Pascal Iron Works.

We had the pleasure, not long since, of a personal inspection of the celebrated Pascal Iron Works, located at Philadelphia, Messrs. Morris, Tasker & Co. proprietors. These works, the largest of the kind in existence, were commenced in a small way, at the corner of Third and Pear streets, in the year 1821. To keep pace with the constantly increasing demand for their manufacture, the firm with that discernment and liberality which is necessary to the successful working of every large manufacturing establishment, determined to erect entirely new works that should embody the most perfect buildings and tools.

In 1836, the proprietors, then consisting of Henry Morris, Thomas T. Tasker, Sr. and Wistar Morris, purchased the tract of land now included between Third and Fifth, Morris and Tasker streets, containing in area about 15 acres; this large space of ground they have literally covered with the buildings of the works, which are stocked with machinery of the latest and most improved patterns.

The original founders of the Pascal Iron Works have been succeeded by the present firm of Morris, Tasker & Co., consisting of Stephen Morris, Thomas T. Tasker, Jr., and Stephen P. M. Tasker.

In giving some idea of the vast energies and resources required to carry on the Pascal Iron Works, we do not propose to describe in detail all the different classes of machinery, their construction and operation; it would require more space than a journal can conveniently spare, without crowding out other matter; we shall therefore confine ourselves to a description of the several branches of this vast establishment.

The general superintending and engineering is entrusted to Stephen P. M. Tasker, Esq., assisted by a corps of competent assistants. The commercial and financial affairs are conducted by Stephen Morris and Thomas T. Tasker, Jr., Esqrs., assisted by William H. Tasker and Edward W. Coit, Esqrs., the general business managers, with about forty clerks.

The principal office is located at the works, with a branch office at Third street below Walnut, Philadelphia, and a warehouse and office at No. 15 Gold street, New York. An independent system of telegraphy connects the works and offices.

On entering the works through the arching on Fifth street below Tasker, one would imagine it required the practice of a skilled engineer to follow the metal in its every process and manipulation, but so perfect are the arrangements and so complete the details, that the most unskilled may trace the material, from the heaps of coal and piles of iron through the boiler tube mill, pipe mill, brass and iron foundries, machine shop, smith shop, boiler shop, testing room, and every stage of the operations to the store house where the several manufactures are shipped. The

MOTIVE POWER

of the Pascal Iron Works consists of nine engines, which exert collectively a force of not less than 600 horse-power; the steam is generated by 15 large tubular boilers; the engines are located at various parts of the works, adjacent to the recipients of their power, and are under the control of a chief engineer and assistants. The

BOILER TUBE MILL,

for making lap-welded boiler tubes and oil well tubing and casing, is a capacious building about 400 feet long by about 200 feet wide; it contains 21 immense welding and bending furnaces, with a capacity of making lap-welded tubing from one to 10 inches in diameter; the fires are not drawn during the entire working week, but are worked by day and night shift; the sheets of iron used are from charcoal furnaces in various parts of the country; they are cut into skelps and scarfed, sheared, bended and then heated in the several furnaces to the required temperature and welded; they are afterwards removed to a building 200 by 80 feet, where the boiler tubes are cut to any required length, and the oil well tubes and cases are screwed and socketed, and proven to a pressure of 300 to 1,200 lbs per square inh, and then inspected and stored ready for shipment. The

TUBE MILL

where gas tube iron is sheared, scarfed and bended, is a building 200 feet long by 60 feet deep, containing thirteen furnaces; after the skelps are welded they are taken to a screwing room where they are cut into different lengths, screwed, socketed and proven to a pressure of 300 to 1,200 lbs. per square inch; gas tube is made from one-eigth inch to ten inches in diameter The

IRON FOUNDRY

is 300 feet long by 200 feet wide, and contains two immense McKinzey's cupolas and pressure blowers, which have a melting capacity of 120,000 pounds daily; it is supplied with flasks, patterns and tools of every description known to the moulders art; the cranes for lifting have great [power, and are constructed with travelling heads and vibratory motion; the treatment and management of the iron is as perfect as can well be dressed, and the castings are equal, if not superior, in appearance and quality of metal to any produced in this country or abroad. The

PATTERN SHOP,

where the wooden patterns used in moulding are made, is 250 by 80 feet, it is stocked with circular and jig saws, planers and other machines which are particularly adapted to the requirements of pattern making; they are perfect in every detail, and are designed especially for executing work with precision and in the shortest possible time. There is a pattern shop connected with the works for making patterns in metal, which are more durable and permanent, and require mechanical skill of the highest order in their construction. The carpenter shop is 50 by 30 feet, to which is attached a a saw and planing mill. The

BRASS DEPARTMENT,

to which is connected a large brass foundry, is 280 by 80 feet, it is constantly employed in the manufacture of steam valves and cocks for gas, steam, and water fittings, stop-valves for station and fire plugs, and every variety of brass work. In this department are tools combining the latest and most modern improvements, such as turret and shaping machines, lathes, planes, etc., etc. The

MACHINE SHOP

is a three story building 200 feet long by 75 feet deep; it is fitted out with a view to the construction of both heavy and light machinery of every description, and contains lathes, planes, slotting and shaping engines, boring mills, and labor-saving machinery of every conceivable construction; in this department all the large and heavy gas works machinery made at the Pascal Iron Works is fitted up. Adjacent to the machine shop is a shop devoted especially to the construction of the celebrated hot water and steam apparatus for heating buildings, from the designs of Thomas T. Tasker, Sr., one of the founders of the Pascal Iron Works. The

SMITH SHOP

is 200 feet by 50 and contains 20 fires. It would be impossible for a journalist to describe in detail all the tools called for in a smithery; suffice it to say that every tool can be found here, from the little swaging and rounding tools to the ponderous steam hammers, cranes, bolt and socket machines, saws and shears for sawing and shearing iron. This shop has facilities for making forgings from a simple bolt to forgings produced by piling, faggoting or packing. The

BOILER SHOP

which is 70 feet long by 60 feet wide, is where are made gas holders of the largest capacity for gas works; hot water boilers, tanks and some special boiler work; the most notable machine is a multiple punch, which punches holes at a single descent of the punch heads, it has punched over 560,000 holes per day; the coil bending shop may be said to be a part of the blacksmith shop; coils of all kinds are made, either plain or galvanized and for every conceivable purpose; tuyere coils, soap coils, etc.; coils have been made in this shop 25 feet in diameter, containing 1,800 of tubing; the gas and steam fitting apartment for cast and wrought iron steam, gas, and water fittings of all kinds is 60 feet by 30 feet. The

GAS WORKS DEPARTMENT

is a very important and extensive branch of the manufactures of the Pascal Iron Wo.ks; it is under the supervision of Mr. Peter Munzinger, gas engineer, who has been connected with this establishment for the last 15 years.

Very valuable improvements have been made in the construction and management of gas works since those erected first in the country. There is scarcely a town from Maine to Florida that has not gas works of the most improved construction.

Messrs. Morris, Tasker & Co. have been foremost in their endeavors to advance the manufactures of gas works and cheapen the production of gas. They build gas works from the most apprrved plans for distilling gas either from coal, rosin, wood or oil. During the past year they erected some of the most extensive gas works in this country; they have supplied the Peoples Gas-Light Company of Baltimore, the Jersey City Gas Works, and the Metropolitan Gas-Light Company of New York with the largest and most perfect gas machi-

nery ever made; for the Newark Gas-Light Company, N. J., they have built two immense cataract washers, from designs furnished by E. Vanderpool, Esq.; besides building numerous smaller works in various parts of the country.

The Pascal Iron Works manufacture Munzinger's Patent Purifiers, having a capacity of 1000 to 2,000,000 cubic feet daily. These purifiers differ from all others, in that they are made in sections and can be enlarged either longitudinally or laterally at will, which makes them a *desideratum* in extending or repairing gas works. A traveling carriage has been designed for floor or overhead use, to accompany the purifiers, to lift the caps when cleaning or charging.

Munzinger's Patent Leveling Stands for Hydraulic Gas Mains, by which the mains can be leveled and adjusted with as much nicety, ease and accuracy as an engineer's level.

Munzinger's Patent Dry Centre Seals with concentric inlet, outlet, and drip pipes, distributing chambers, rotary distributing and shut off valves, and angle boxes for changing the direction of the gas flow.

Munzinger's Patent Wooden Lime Trays for Purifiers, the construction of which prevents the gas from acting upon and destroying the tie rods, rendering them practically indestructible.

Munzinger's Patent Water Condensers, which are built with inlet, pipe and outer chambers, and have outwardly projecting flange joints for bolting the sections together; like the purifiers they can be enlarged indefinitely; the condensing pipes have conical socket joints, so that a defective pipe can be driven out and replaced without interfering with the other pipes, and Munzinger's Automatic Indicator and Pressure Alarm, for indicating and locating any defective pressure in the gas pressure of mains, by the application of the gas pressure in connection with an electro-magnetic alarm bell and indicator. It is an ingenious, self-acting instrument, which is equally admired for its efficiency and simplicity; its action is entirely inpependent; the pressure in the gas mains cannot increase or decrease beyond the limit of its adjustment, without ringing a bell and indicating the place of disturbance at the engineer's office.

The Pascal Iron Works not only build gas works but supply in detail all the parts composing the same, as retorts, tar gates, wrought or cast iron stand-pipes, wrought or cast iron retort lids, exhausters and compensator, by-passes with a flow of from 4,000 to 15,000 cubic feet of gas per hour, engines, gas governors, single or multitubular scrubbers with self-acting pumps for ammonia water, cataract and single multitubular spray washers, square and round meter cases of any capacity, single lift and telescopic gas-holders with cast or wrought iron suspension frames, station governors with regulating and indicating columns for inlet and outlet pipes, also dry governors with flexible diaphragms for underground pipes, gas-holder tanks, lamp posts and lanterns, pressure and vacuum gauges, cotter bars, coal and coke wagons, stokers, gas and steam fitters' tools, and all other articles connected with the manufacture of gas.

It may assist in measuring the capabilities of the Pascal Iron Works, and the enterprise required to keep them in motion, by stating that there are at the present time over 1400 operatives on the pay roll. During the year 1870, 30,000 tons of hard and 2,000 tons of soft coal, and 25,000 tons of iron were used sumed in the various manufactures.

The Brooklyn Water Department.

ANNUAL STATEMFNT OF THE COMMISSIONERS.

The annual statement of the Brooklyn Water Department, for the year 1870, was submitted to the Board of Aldermen on the 7th inst., from which it appears that the receipts from water rates from January 1st, 1870, to January 1st, 1871, were as follows:

Regular rates	$439,231 53
Extra rates	174,614 12
Default &c	28,923 71
Net receipts in the year	$642,769 36

This is an increase as compared with the report of January, 1870, of $60,113 51.

The commissioners call attention to the fact that notwithstaading the increased amount of water, reaching four hundred millions gallons more than last year, and the increased cost of supplying that largely additional amount, yet the current expenditure of the whole department is less by $21,000 than the year previous.

Owing to the fact that increased expenditure is demanded in meeting the extra interest to become due on the amount of $1,400,000 for extension of the parks, and from the fact that the prices charged for the use of water per house is from 30 to 60 per cent. less than in other cities, the Commissioners have, after careful deliberation and examination of the subject, recommended to the Common Council the adoption of an ordinance, which, while increasing the rates of water to a point which in the opinion of the Board will give sufficient revenue with prudent management to make the department sustain itself, while leaving the rate per house much less than that charged in other cities of about the same size as our own.

The necessity for storing the water which now runs to waste at the sources of supply, is dwelt upon at length.

The use of water by the city last year was unusually large, averaging 18,280,000 gallons daily.

The works, ponds, &c., are represented to be in generally good condition.

The number of miles of sewers built during the year was 33 26-100, of which 7 35-100 miles were of brick, varying from two to seven feet in diameter.

In relation to the streets, the Commissioners state that the repairs have been numerous, and extend over the entire city; but the area of badly paved streets is so great that the work done is, from necessity, not commensurate with the wants of the city in this respect.

Dr. Newberry's Classification of Ohio Coals.

Following an economic classification, our coals may be described as, first, dry, open-burning or furnace coals, second, cementing or coking coals; third, cannel coals.

The first of these includes those that do not coke and adhere in the furnace, and are such as may be used in the raw state for the manufacture of iron.

The second group, to a greater or less degree, melt and agglutinate by heat, forming what blacksmiths term a "hollow fire." This property causes them to choke up the furnace and arrest the equal diffusion of the blast through the charge. Hence they cannot be used in the raw state for the manufacture of iron, but must be "coked." This process of coking consists in burning off the bituminous or gaseous portion; which leaves them in the condition of anthracite, except that, as this change is effected without pressure, the resulting material is cellular and spongy. Coals of this character, when free from sulphur—their great contaminating impurity—are used for the manufacture of gas; the volatile portion, driven off in the retorts, serving the process of illumination, while that which remains is coke, and may be used as fuel.

The cannel coals have usually a more distinctly stratified structure, and more compact and homogeneous in texture, and contain a larger percentage of volatile matter than the others; also the gas they furnish has higher illuminating power. Hence they would be used, to the exclusion of all others, for the manufacture of gas, only that the coke which they furnish is of inferior quality. They are therefore, for the most part, employed as household fuels—for which they ara specially adapted—and, in small portions, for enriching the gas produced from coking varieties.

The marked differences exhibited by the kinds of coal I have enumerated, are doubtless due, principally, to the circumstances of their formation. The furnace coals have generally a distinctly laminated structure, and are composed of bituminous layers separated by thin partitions of a material allied to cannel, which does coke. *Hence the bitumen in them is held in cells*, and cannot flow together, and give the mass a pasty, coherent character.

The cementing coals have few such partitions, but show, upon fracture, broad, brilliant surfaces of pitch like bitumen. Both these varieties are supposed to have been formed in marshes; where they were saturated, but not constantly covered by water. The cannel coals were deposited in lagoons of open water in the coal marshes, where the finely macerated vegetable tissue accumulated as carbonaceous mud. Hence they have a large percentage of hydrogen, and their gas has high illuminating power. Hence also the remains of shells, fishes, amphibious and crustacea—all aquatic animals—so generally found in them.

In Ohio it chances that the *lowest stratum in the series is generally a furnace coal.* Along the northern line of outcrop this is known as the "Briar Hill Coal." This coal enjoys a deserved celebrity for its adaptation to the manufacture of iron, and now furnishes the fuel by which half the iron produced in the state is made. In consequence of the structure of our coal basin, this coal stratum, underlying all the others, and dipping towards the south and east, is, for the most part, covered by the overlying rock. As a consequence, up to the present time it has been worked only along its line of outcrop, and the great area it occupies below drainage is almost untouched. It is plain, therefore, that the time is not far distant when our people will be driven to reach and work it by shafting. In Ohio we have as yet sunk but two or three shafts, to reach seams of coal, and these to no great depth; while nearly all the coal mined in Great Britain is obtained by shafting—sometimes to the depth of 2,000 feet. By carefully studying the dip of the rocks (which is not uniform, but is frequently counteracted by folds that elevate or depress the coal seams from their normal planes), we shall be able to do much to guide the efforts soon to be put forth to reach it. *Some localities are already known to me where this Briar Hill seam, far from its outcrop, rises much nearer the surface than it was supposed to be. Other like localities will doubtless be discovered, upon careful search.*

Another seam of coal which has this open-burning character is that known as the "Hocking Valley coal," found fifty or sixty miles southeast of Columbus, and over an area—estimated by Prof. Andrews, who has carefully studied that district—of not less than six hundred square miles, maintaining a thickness of from 6 to 11 feet, with a remarkable uniformity and purity of composition. Should this coal be capable of use in the raw state as a furnace fuel, it is destined to assume an importance second to no other in the State, and to form a basis upon which a manufacturing industry will be established in its viciniuty, by which not only that section but the entire State will be enriched.

By far the greater portion of our coals are, however, of the coking variety, and while these, up to the present time, have been but little used as furnace fuels, it is certain that the general estimate of their value in this connection is a mistaken one, and that by proper management they can be so used as to accomplish all the purposes of the furnace coals, so called. In the Old World, three-fourths of the iron produced is manufactured with coking coals; and it is only necessary that the processes followed there should be adopted here to insure an equally good result, except so far as effected by the difference in the price of labor, To investigate the peculiarities of the different seams of coal included in this class, and prescribe the best method to be pursued in their use, is a great and important duty to be performed by this or some other Geological Board, and one that will add millions annually to the revenues of our people. In order to show how important this work is, I will only refer to the manufacture of iron in our southeastern counties, until recently the most important centre of iron industry in the State. Here there is an abundance of excellent ore, and forty furnaces that have been for years using charcoal for its reduction. But the supply of fuel afforded by the forest growth of a country is comparatively small, and it has there been already to a large extent exhausted. Now this region abounds in coal, though mostly of the coking variety, and it is evidedt that its prosperity and progress will hinge upon the intelligent adaptation of the coals found there to the purposes heretofore served by charcoal. If the mineral fuel of this portion of the State can be successfully employed in the reduction of its ores, the iron manufacture may be expanded to an indefinite extent; without this, it must not only cease to advance, but diminish.

Already an exhaustive investigation into the properties and adaptations of the different Ohio coals, has been begun by the Geological Corps. This should be continued until every owner of coal lands, in every county in the coal area, shall know with accuracy how much and what kind of coal he possesses, for what it is fit, how much it is worth, how it can be worked, and where it is to be marketed. It is not too much to expect, that, when this investigation shall have been completed, the industries of the State will be sensibly affected and very much expanded by it.

Peat Fuel for Locomotives.

The managers of the peat works near Meriden, Conn., have published in the *Iron Age* the following account of the use of peat fuel in locomotives. Although we do not credit some of the assertions—for example, the one stating that bituminous fuel and peat together are superior to either alone—we give the sketch as pertaining to a subject of considerable public interest:

"The locomotive, *C. L. Pond*, although especially designed for a passenger engine, has, during the past forty days, been kept hot on passenger, freight, and switch duty, for the purpose of giving the fuel a complete test under all conditions. She is an engine with cylinders, 15 by 20 inch, 6 feet drivers, fire-box 38 by 47, and copper flues. She has in duty accomplished results with peat fuel nearly equal to that of coal.

"The advantages in the use of peat fuel over coal are combined in the following, each and all observed during this practical test:—No destructive agent, such as sulphur, phosphorus, or arsenic, exists to corrode the grate-bars, sheets, or flues; there is no accumulation or deposit of clinker or unburned peat upon or between the grate-bars; no incrustation of soot along the flues; no deposit of ash in the smoke-box; nor is there any emission of heavy sparks, lighted coals, or smoke from the top of the stack—*four very important considerations* in the expense of keeping the railroad locomotive in prime condition and always ready for service.

"The depth of the fire over the grate-bars is seldom

over 9 inches, or, say, 250 lbs., continually burning fuel. With this even and never exceeded amount, steam can be kept at any desired pressure above 100 lbs. per square inch, without difficulty, by any intelligent fireman. The number of times for shoveling or feeding the fire is so much more frequent than coal as its density is less, but not necessarily proportionately laborious; for the fire-door may remain open for a long period, or, in other words, may be opened, the grates fed, and then closed without any haste in the operation. The relative effect of this peat fuel, as compared with coal, is now shown by the following carefully observed results, obtained by weight of fuel used, and water evaporated from the tender:—The locomotive *C. L. Pond*, running the passenger express from Hartford to Springfield, and return, with a train of two, three, or four cars (as demanded)—distance from Hartford to Springfield, 26 miles; number of stops, 8; time (by card of railroad), 65 minutes; allowing 3 miinutes per stop, is 24 minutes; leaving running speed for 26 miles, 41 minutes, at a rate of 38 miles per hour—has afforded, by average of some twenty-five trips, this result;—The trip up and return, distance 52 miles. Peat fuel used for the whole trip, 2,620 lbs; water evaporated, 2,331 gallons—or, reduced to pounds, say, 18,209 lbs,—which equals 6·95 lbs. of water, *cold*, evaporated by 1 lb. of peat fuel; the *aserage* pressure having been throughout the trials 105 lbs. *per square inch*, or 7½ atmospheres, Under fair condition of track and good weather, a result was obtained of 7·75 lbs. of water for 1 lb. of peat burned. The above, if desired to be calculated by size of cylinders, diameter of driver, speed, and pressure for distance run, will prove conclusively the above statement, showing, say, 139,890 cubic feet of steam, or 200 cubic feet of water (2,331 gallons), by consuming 2,620 lbs. of peat-fuel.

"No doubt exists that, by better knowledge of the way of firing, the above result *can be exceeded*, which if it shall be the case, will place peat fuel *above coal or wood*, at *one-half the price*, throughout the whole domain of the United States; for the deposits of peat are everywhere evenly and generously distributed. The duty of the bituminous coal, as used in the United States, is found to be from 7 to 10 lbs. to evaporate 62½ lbs. of water. The above especial duty, under careful manipulation, shows peat at 9 lbs. to 62½ lbs. water—a result almost equivalent.

"Coal-producers need have no fear of the introduction of this plebeian fuel, for sundry experiments have shown, by a proper admixture of bituminous coal with peat-fuel, a heat is quickly raised that will *far* outstrip *either*, alone, in evaporative results.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessary for publication, but as a guarantee of good faith.—EDS.

h "Synopsis" Preferable to Raiment.

WARE, MASS., January 25, 1871.

Messrs. Editors: I wish you to add my name to the list of subscribers ol "Smedberg's Synopsis of British Gas Lighting." I would rather go without my coat than go without such a book. I remain, yours truly,

WM. MEDCALF,
Supt. Ware Gas Light Co, Mass.

Seeking Information.

QUINCY, ILL., January 28th, 1871.

Messrs. Editors: Can you give good reason for the many accidents lately occuring at different gas works throughout the country? Is it owing to *carelesness, ignorance*, or a *radical defect* in *construction?*

Will you be kind enough to furnish your many readers with all the information you can obtain, about the causes of the late disasters at Cincinnati, Worcester, and Brooklyn, and much oblige an old and constant reader of your valuable Journal. Yours truly,

W. H. CORLEY,
Sup. Quincy Gas Light and Coke Co.

[The causes have been given in past and present nummbers of the Journal.—EDS.]

Smedberg's Synopsis.

The following additional subscribers to the above work are herewith acknowledged, making 316:

C. F. Osborne, Supt. Gas Works, Minneapolis, Minn.

E. S. T. Kennedy, assistant Supt. Citizens Gas Works, Newark, N. J.

Troy Gas Light Co., N. Y.

Sam. Shipman, Pres. Marietta Gas Light Co., O.

Riverside Water and Gas Works Co., Riverside, Cook Co., Ill.

W. A. Strong Jr., Joliet, Ill.

Geo. H. Philips, Hamlltoh, O.

Chas. C. Van Benschoten, New Rochelle, N. Y.

TO INVENTORS AND PATENTEES.

This Journal, circulating, as it does, throughout the United States, Canadas, and portions of Europe, is a superior medium for advertising.

Upon receipt of $3 we will send the Journal one year, and give a special description of any new invention of the subscribers, in the Inventors' Dapartment.

We, also take out Patents in the United States and Europe, obtain Extensions, and make a *Specialty* of difficult and abandoned cases.

M. L. CALLENDER & CO.,
No. 42 Pine street, New York.

Inventors' Department.

Patents are granted for seventeen years, the following being a schedule of fees:

On filing each Caveat	$10
On filing each application for a Patent except for a design	15
On issuing each original Patent	20
On appeal to Commissioner of Patents	20
On application for Reissue	30
On application for Extension of Patent	50
On granting the Extension	50
On filing a Disclaimer	10
On filing application for Design (3½ years)	10
On filing application for Design (7 years)	15
On filing application for Design (14 years)	30

RECENT AMERICAN PATENTS.

Pertaining to the Specialties of this Journal, for the three weeks ending January 21st, 1871.

111,298.—Steam Generator.—Chris. Ahrens and Frank Kamman, Cincinnati, O.
111,316.—Pump.—Herman Camp, Rouseville, Pa.
111,331.—Vapor Generator for Vapor Engines.—J. A. H. Ellis, Springfield, Vt.
111,341.—Valve for Steam Pumps.—Joseph F. Hamilton, Alliance, O.
111,349.—Pump.—T. O. Jones, Galesburg, O.
111,354.—Pump.—T. J. Lapsley, Nashville, Tenn.
111,381.—Water Wheel.—J. B. Reyman (assignor of one half his right to Donald W. Campbell), Sprinfield, Mo.
111,387.—Water Grate.—Jos. Ryan, St. Louis, Mo.
111,439.—Seal for Dip-Pipe in Gas Works.—Grafton C. Douty, Columbus, O.
111,440.—Seal for Dip-Pipe in Gas Works.—Grafton C. Douty, Columbus, O.
111,474.—Machine for Drilling and Tapping Water and Gas Mains.—Jas. Riley and Patrick Riley, New York city.
111,486.—Manufacture of Illuminating Gas.—Ira N. Stanley, Brooklyn, N. Y.

FOREIGN PATENTS.

Applications made by Americans for British Patents fol the week ending January 27th, 1871, reported for AMERICAN GAS-LIGHT JOURNAL by our London Agents.

11.—Lamps and Burners.—R. S. Merrill, Boston, Mass. dated 3rd.
29.—Steam Boilers.—W. B. Mack, Phila, Pa, dated 6th,
85.—Steam Generator.—J. F. Allen, N. Y. city dated 12th.
164.—Engines.—A. K. Ryder, N. Y. city, dated 21st,
184.—Liquid Meters.—J. F. de Navarro, N. Y. city, dated 24th.
212.—Steam Boiler.—J. Lorillard, N. Y. city, dated 26th.

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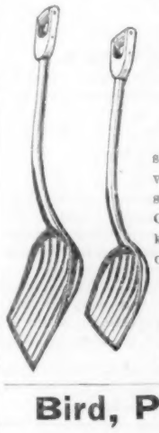

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

THURSDAY, FEBRUARY 16, 1871.

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General Editorials.

THE LATE EXPLOSION AT CINCINNATI.

The Commissioners of the Board of Directors of the Cincinnati Gas-Light Company, have made a report of the result of their investigation into the recent explosion of gas holder No. 5 of that works, on December 19th, 1870.

They find, "that from a grave error ef judgment, arising from a want of *experience*, *knowledge*, or *care*, on the part of those who had charge of the works at that time," that too much gas was made for the storage capacity of the works, and as a consequence holder No. 5 was filled so full that it "blowed"; that, while the gas was thus escaping in large volume from the holder, it came in contact with the light in the exhauster room (only some ten or fifteen feet from the holder) ignited the gas, and finally resulted in the explosion of the new and beautiful holder, in throwing down most of the columns, and the destruction of other property, beside some 500,000 cubic feet of gas, comprising that within the holder and what was wasted, during the time occupied in getting things in working order.

From a consideration of this report the question arises, whether the Directors of the Cincinnati Gas Works, or those who have control of the appointments, have not themselves committed a "grave error of judgment," in appointing to such a responsible position a person "whose want of experience, knowledge, or care" was so inferior, as to permit such a condition of things to exist? The responsibility of this state of things must rest somewhere; the lives of some two hundred or more employees, of persons residing in the neighborhood, of those who might be accidentally passing along, when such an accident occurred, are all too sacred to rest on such a slight tenure as a "grave error of judgment," resulting from causes and conditions which should not exist.

Is there any way by which the Directors, or "powers that be," could secure a competent man to fill the place? We think there is. It is a well known fact that throughout the country there are quite a number of well conducted small gas works; that in charge of these works are men of cultivated talents, large experience and thoroughly posted in all practical matters, fully competent to take the position of superintendent of any works; for years they have conducted the works under their charge, with great satisfaction to their employers, but with small profit to themselves; as the salaries generally paid are rarely commensurate with the services rendered, and little more than sufficient for the moderate support of themselves and their families.

Now, would it not have been the part of wisdom in the "powers that be," if the Cincinnati Gas Company, on the death of their late superintendent, Mr. Martin, to have looked around and secured one of this class of men to fill the vacancy thus made? The cost and style of living in Cincinnati is higher and different from that in most country towns; that position should command such a salary as to make a change desirable to most country gas superintendents. There would be few who would not be willing to take this position—one of great responsibility and trust—for the interest on the sum lost by this very explosion (say $75,000 at even 6 per cent).

Such being the case, the company are derelict in not securing men of large experience, and thoroughly acquainted with all the practical duties of the position, instead of employing men who lack "experience and knowledge," and are not wide awake enough to exercise the requisite "care" in the conduct of such a large establishment as the Cincinnati Gas Works.

Unforseen accidents may occur under the supervision of men of great experience—witness the explosion of last summer. Possibly there was a "grave error of judgment" in that case, as far as the condition of the tank was concerned; yet, a man, in violation of a well known and stringent rule of every well conducted gas company, in a thoughtless moment, performed an act by which his own life paid the forfeit.

Again, the recent explosion at Worcester, Mass., Mayor Blake, a gentleman of large experience, well informed, thoroughly acquainted with all the minutae of manufacturing gas, with his superintendent with him—yet in an unguarded moment, without the requisite presence of mind, to think of the danger of taking a lighted lantern to examine into the state of the machinery in the basement of his purifying house, the whole air being, as it must have been, thoroughly saturated with gas, an explosion took place, and he thus paid the forfeit of his life.

Such unforseen circumstances may occur to the best men, yet the Directors, or those having charge, having with due diligence striven to secure the best man they could find, under the circumstances, to fill the position, an accident then occurring, and that fact being made known to the public, they would be exonerated from all blame, by an intelligent community conversant with the fact.

THE GIBSON GAS VALVE.

In a former number of the Journal the attention of our readers was called to an improvement in gas-apparatus, the invention of Mr. Gibson, by means of which dip-pipes are dispensed with, and for which it is claimed that it is capable of effecting a very important saving in the manufacture of coal-gas.

This invention has now been in constant use for more than a year and a half, and is making its way, like most other improvements of value, *slowly* into general use; more *slowly* than many, for certainly no gas engineer, upon mere presentation, would be inclined to attribute to it the merit which is claimed for it.

Inventors are generally sanguine as to their schemes, and it is natural that they should be so, their minds being absorbed by them. Their figures not unfrequently *seem* to prove that which, though difficult to controvert, is nevertheless untrue, the assumed premises being erroneous.

In the instance to which attention is called, the invention is not the result of theoretical speculation; so far from it, it is quite certain that no intelligent gas engineer would ever accredit to it the importance it possesses, without the most positive evidence; for the proportional part of the pressure upon gas retorts, caused by dip-pipes where that caused by the purifyers, transit pipes, and gasholder, is not overcome by an exhauster, is apparently insignificant. Had it not have been proved, by experience, that the chief cause of the hard carbon deposited in the retorts was attributable to the dip-pipes such a statement would not be credible, and with the demonstrations afforded by retorts which are now, and have long been, in use, we are at a loss for a full and satisfactory explanation of the fact.

We cannot, however, ignore demonstration, however unsatisfactory may be our explanation of the reason why, of the truth demonstrated; and, in this instance, the experience of a year and a half has shown that where the invention

has been applied, the deposits of carbon, so universally formed within gas retorts connected with dip-pipes, is avoided.

It is by all admitted that the source of this troublesome deposit is the light-giving portion of the gas generated—the *illuminants*—and, this being admitted, it does not require an argument to show that if it is prevented, it must follow that the gas which passes from the retorts *must* possess a *greater illuminating power:* or, that a *larger quantity of gas, of equal illuminating power*, may be produced from a given quantity of coal.

In works where the invention has been adopted experience has shown this to be the case, and that the engineer, by reducing his charges of coal, obtains as much gas, of as high illuminating power, as he before obtained; effecting at the same time a very important saving of coal.

Experience has also demonstrated that there are no practical objections to its being brought into general use, and that the retorts to which it is applied are as easily managed as the retorts in common use in all gas works.

CATS AND DOGS AS A GAS MATERIAL.

How to Improve Gas.—Gas consumers sometimes complain of gas smelling badly, and of the emanations from it soiling the picture frames and other gilt surfaces of the furniture. There may be an explanation of this in the occasional pranks of the gas works men. Mr. Chichester, a gas engineer of New York, writes to the *American Gas-Light Journal*, mentioning a case where a gas workman in his employ quarrelled with a big dog, and having killed the animal, threw his body into the retort, and, adds the engineer, "the gas at the test burner was much improved. Since that time it is no unusual thing to see the men engaged at these works dragging a dead cat or dog along with them when going to their work." One would suppose, without going closely into the chemistry of the matter, that it is no unusual thing for the people who use that gas in their houses to feel headaches and other maladies resulting from vitiated atmosphere.

We clip the above from that excellent and wide-awake paper the Brooklyn *Eagle*, as going to show two things. First, the aptitude and readiness with which the new ideas advanced in the Gas-Light Journal are put into practical operation by the fraternity. Second, how easy it is to get an erroneous idea of the effects upon illuminating gas of dogs, cats, or other animal matter, in the chemical process of decomposing the same into the gaseous elements which go by that name. The crude gas produced from coal by the usual process, is far more disagreeable in its odor than the gas produced from animal matter, because it contains more of the sulphurous compounds, and especially bisulphide of carbon, which is the most disagreeable odor imaginable, being similar to rotten eggs. But the writer in the *Eagle* will please remember that all gas is elaborately "purified" or freed from all these objectionable impurities before it is distributed to the consumers, whether made from coal or other materials. The small amount of sulphuretted hydrogen (odor) remaining in the gas after purification, is really an element of security against accident. If the gas had no odor its presence in any room or situation by leaking, would not be discovered until an explosion occurred.

In a practical point of view, we personally consider the employment of cats and dogs as a substitute for coal in gas manufacture, an idea which can be extended to the benefit of the communities of our cities generally, in more than one sense. The amount of gaseous material that can be obtained from a good fat canine is remarkable—the fatter the animal, the better. Hence well fed "poodles" and pampered "tabbies" would naturally bring a premium for gas purposes. Mad dogs are not good for gas purposes, because of their leanness; therefore it would not pay to attempt to make it a permanent business to supply gas works with dogs that "froth at the mouth." It is on this account that the season of "dog days," and that when the "dog star rages" are poor times to contract to supply gas works with that kind of coal substitute. Not wishing to be dogmatic however, we will say, let those who are any way sceptical on this point try the experiment for themselves, and if it results in bringing them before a modern Dogberry, it will be a sad ending to the "tale of the dog"—minus the wag.

To extend the subject, we understand that the French engineers utilize the mummies in the Catacombs of Egypt for gas purposes, the bituminous wrappings greatly increasing the "candle power" of the gas. This modern method of cremation is a post mortuary ceremony, no doubt little anticipated by the Pharaohs.

The large amount of carbon contained in animal matter, and its gas-producing as well as heat-producing qualities are pretty well understood by the Engineers and Captains of the steamboats on our western waters. It used to be no uncommon thing for them, during racing contests, to increase the heat of the furnace fires, when hard pressed, by introducing lard, butter, oil, carcasses of hogs, beef, etc., and it is said that the embodiment of the fifteenth amendment was so little respected then, that sometimes when hog gave out a good fat n— amendment has been known to be substituted, and found to increase the speed of the boats wonderfully.

As for cats, city cats especially are a crying evil, particularly about midnight, when one is tired and sleepy, and most likely unwittingly and dreamily to most wickedly s—nore. Some people may have a fellow-feeling for cats, but we have a different feeling; whenever we see one in the street we feel for a loose cobble-stone, and incontinently transform ourself into a catapult. The objective point being the cats. Ditto the dogs. We categorically assert, that if cats will make good gas, then should every red hot gas retort be used as a catacomb. The assurance of such an eventful catastrophe would be a cataplasm to our lacerated feelings, and at the same time afford us more light upon the cats ways, which are dark. We don't like cats, especially city cats. Dogs likewise.

THE GAS COMPANIES.

Mr. Dennis Burns recently introduced a good bill in the state Assembly,

—"providing that it shall not be lawful for any gas company in New York city to charge gas consumed in any house or premises to a new or different occupant, or to refuse to provide gas to a new or different occupant until a past use of gas by another or different party is paid for, under a penalty of forfeiture of their charter for every offense. Where the gas furnished to consumers monthly exceeds one million feet, the charges shall not exceed $2 50 per one thousand feet consumed. Where deposits are made for the use of gas, seven per cent. interest shall be paid on such deposits, and such interest shall be due and paid every three months; but no company shall be allowed to require a deposit from any person desiring gas in a sum greater than for an amount that person would be likely to consume in fifteen days."

We print the above, as a specimen of the average run of the yearly crop of the bills introduced by some of our State legislators, to regulate the Gas Companies, and benefit whom? Pray, how would the gentlemen who are so eager to make special laws for others like to have the same rule applied to them. The full remedy already lies in the civil law, to compel a gas company refusing to provide gas to one party, in order to force said party to pay the gas bill of a former occupant of the premises. Besides gas companies do not attempt to practice any such system of coercion as the wording of this bill would seem to imply.

Every reasonable man must see the absurdity and injustice of arbitrarily forcing a gas company to sell gas at a lower and fixed price, whenever by large investment of capital, careful management and enterprise enables them to make and furnish one million feet of gas monthly. If Mr. Burns by a large outlay, industry and energy, succeeds in building up a monthly business of 3,000 dollars in dry goods, groceries, or coal, or the manufacture of—say whiskey, would he be willing to sell thirty per cent. less than when he did a business of one half that amount?

The clause regarding the interest upon deposits may appear to have some merit at first sight, upon general principles, but the very small and numberless depositors would make it an endless and costly task to comply with the law, making the expense nearly equal probably, to the original interest.

The last clause regarding deposits is simply an attempt to legislate for the benefit of those whose moral principle is either slightly or materially obscured, or are conveniently forgetful about settling the last little gas bill, especially before the *hegira* of the yearly moving day.

Let Mr. Burns be compelled to trust all his customers 50 per cent. of their monthly trade in groceries' coal, or whiskey, and particularly during the month of April! He would then know how it is himself.

GAS ENGINEERS ASSOCIATION.

We have from time to time urged the great necessity of an association of gas engineers, the object of such an organization being to learn from each other's experience, the best and most economical processes for making gas, for the protection of those engaged in its manufacture, and also, as a means of social and intellectual intercourse among our gas managers toroughout the United States.

Although our efforts met with considerable favor, and much correspondence followed, which was published in the Journal, giving the ideas and suggestion of various parties, still the point aimed at—a convention—failed.

We are happy to announce, however, that the New England gas engineers have made the proper movement.

At the funeral of the late lamented Jas. B. Blake Mayor of Worcester, who died from the effects of the late explosion in that city, seventeen gas companies were represented, and preliminary steps were taken to form an association to be called the New England Association of Gas Engineers. Pursuant to the above a meeting was held in Boston, Thursday, Feb. 2nd, and the organization was completed with the following board of officers:

PRESIDENT.

W. W. Greenough, Boston,

VICE PRESIDENTS.

Geo. Dwight, Springfield.
Wm. York, Portland.

SECRETARY AND TREASURER.

Geo. B. Neal.

DIRECTORS.

Jno. H. Hill, Concord.
Jas. H. Armington, Providence.
O. E. Cushing, Lowell.
Geo. D. Cabot, Lawrence.
David Moore, Salem.

It is to be hoped the association when it is complete and inworking order will go on, and let its light shine and not let it be "hidden under a bushel." We congratulate the present association upon so favorable a commencement, and in having such efficient officers and directors, which of itself is a guarantee of its success. It will afford us pleasure to co-operate in any way deemed proper or expedient at any time for the advancement of this most excellent enterprise.

GRAHAMITE; AN ERRATUM.

One of those annoying accidents to which Editorial patience is sometimes scarce equal, occurred in the article in our last on Grahamite. In the table giving the Philadelphia tests, which had not been yet set up at the time of reading of the proof, the column of candle powers must needs be omitted, another column being repeated by the types instead. We therefore here reinsert the whole table:

(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	7.)	(8.)
Materials.	No. of Charges.	Weight of Charge in Pounds.	Feet of Gas per Pound.	Candle-Power of five ft.	Value of one ton in pounds of sperm.	Direct percentage Gains in the mixture.	Computed Value in Pounds of Sperm per ton, of the Grahamite in the mixtures.
Grahamite	20.	50.	6.7	30.	1540.		
Penn. Coal	20.	100.	4.8	16.	590.6		
Grahamite 1)	44.	50.	5.2	20.	799.	35.3	1632.6
Penn. Coal 4)							
Cameron Coal	24.	100.	4.72	10.24	371.2		
Grahamite 1)	64.	50.	5.21	17.64	705.7	90.1	2043.7
Cameron 4)							
Shafton Coal	22.	100.	4.88	20.25	758.9		
Grahamite 1)	52.	50.	5.61	29.16	1256 3	65.6	3245.9
Shafton 4)							

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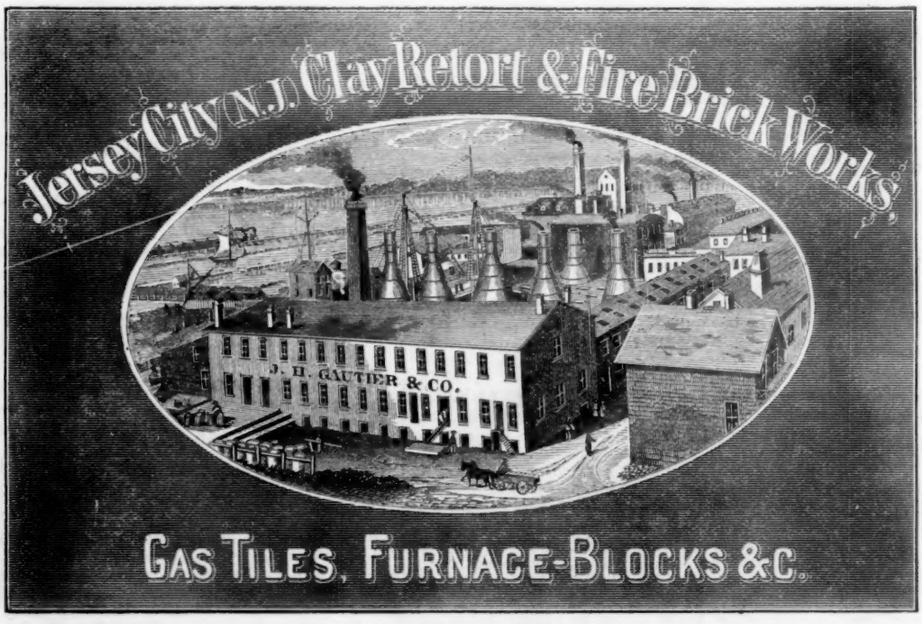

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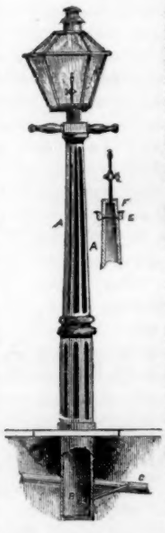

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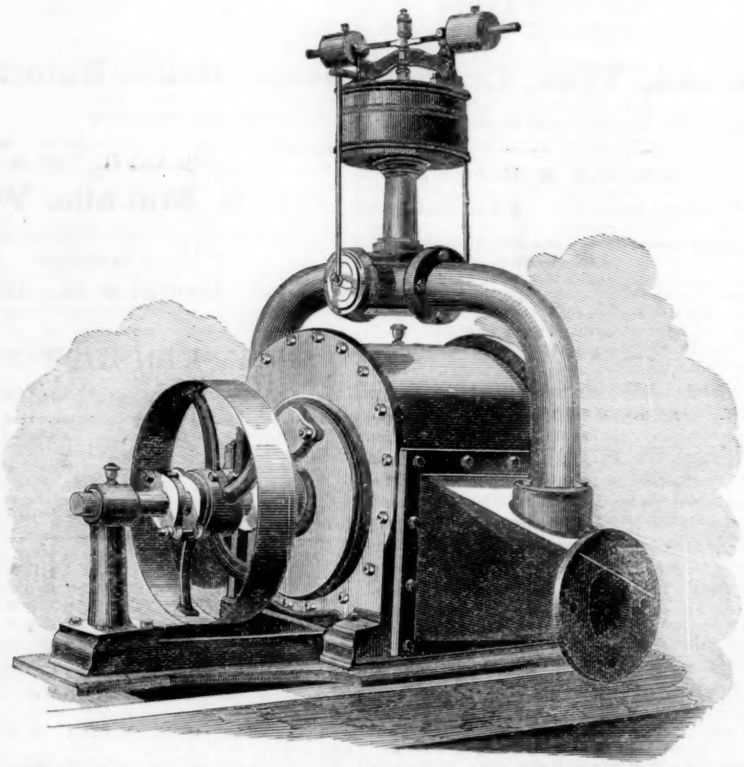

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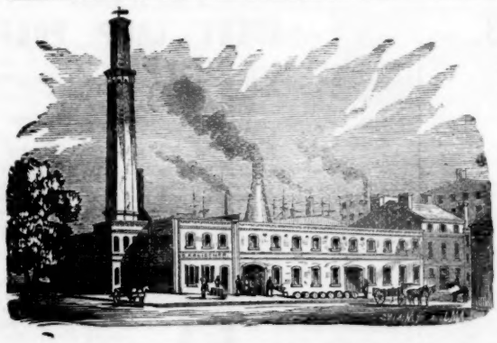

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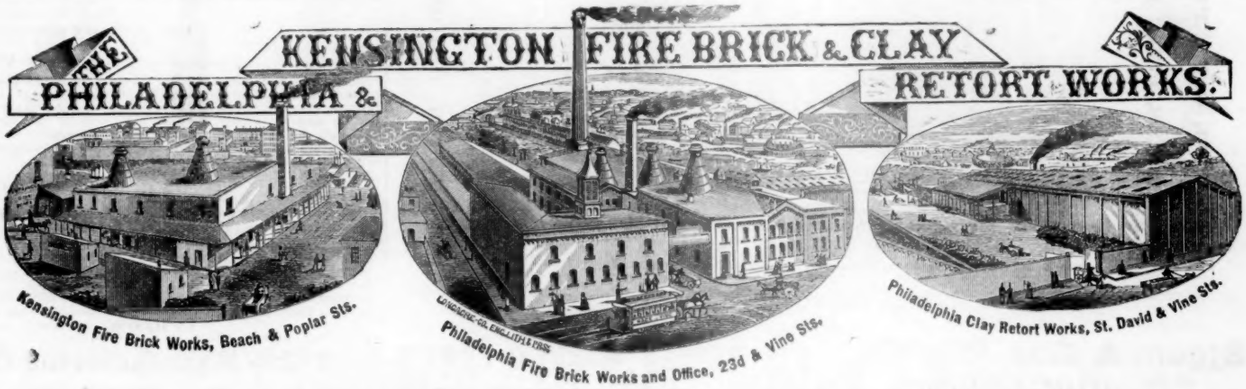
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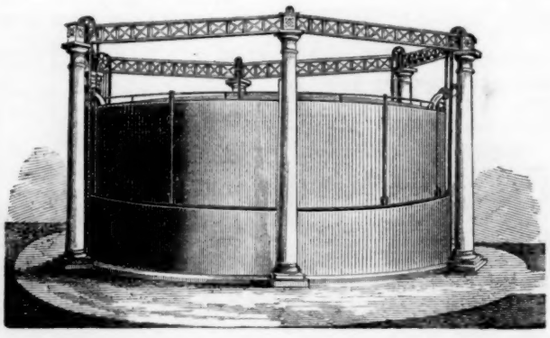

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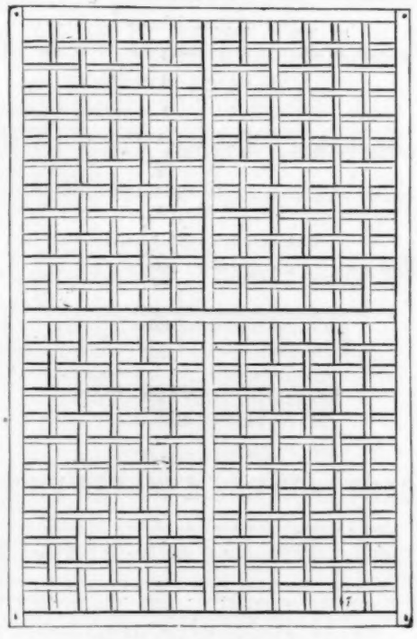

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The Screen is made with an Oak Frame, interlaced with split rattan drawn through holes at regular intervals in the Frame and cross pieces, the edges of the frame being grooved to prevent abrasion.

The advantages of the Screen are:

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4th. Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any other now used.

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Mr. E. Duffee—Dear Sir: We have used your Trays for the last five years in our works, and find them to last the longest, and give the best satisfaction of any we have ever used.

Respectfully yours,
WM. W. WEST, Supt.

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J. M. SOMER,
Supt. Chelsea Gas Co.

DORCHESTER, March 3, 1870.

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W. B. BROOKS,
Agent Dorchester Gas-Light Co.

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Respectfully yours,
W. H. PERRY, Supt.

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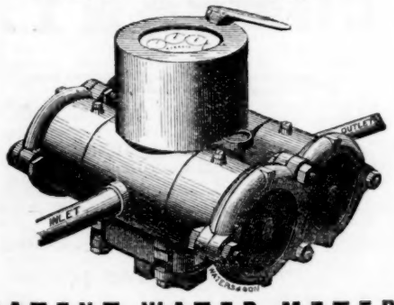

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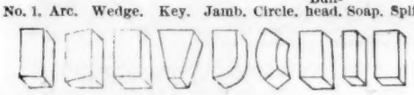

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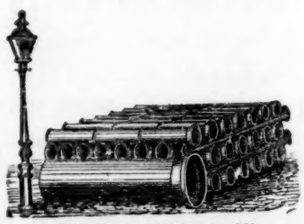

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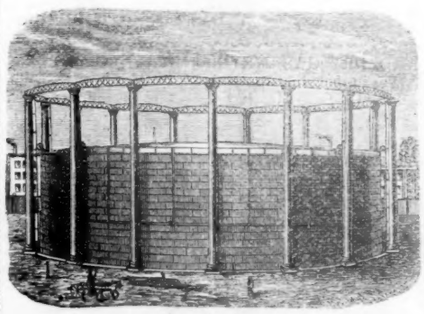

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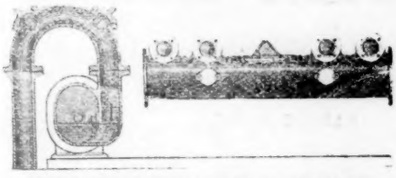

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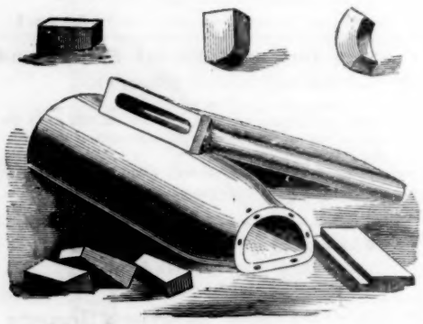

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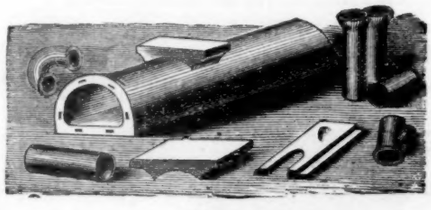

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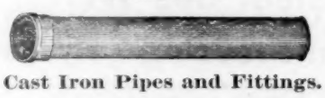

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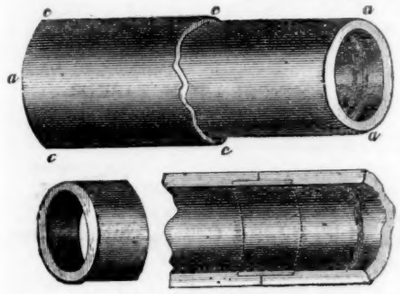

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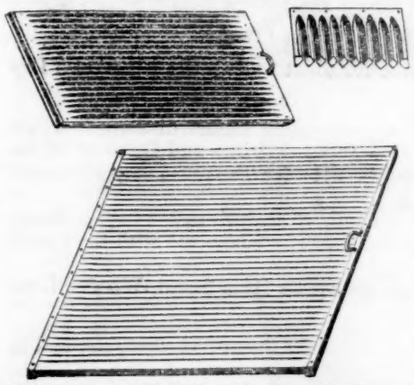

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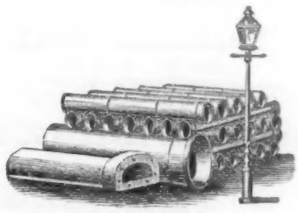

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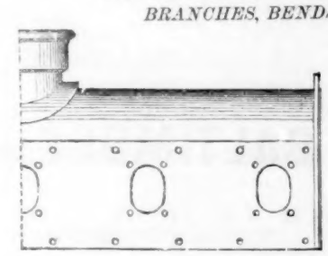

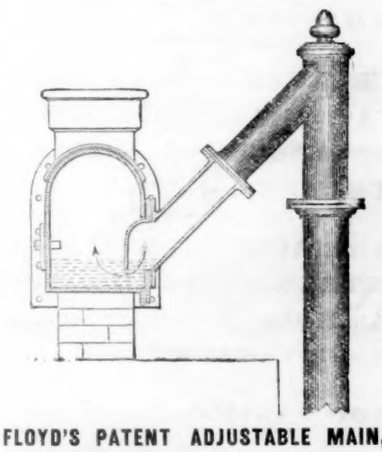

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